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ELECTRIC VERSUS *GAS LIGHTING.*

L'Éclairage Électrique actuel dans Différents Pays. By Jules Couture. (Paris: J. Michelet, 1890.)

IN this, the second edition of this pamphlet, a comparison is made between the prices of lighting by electricity and gas at Milan, Rome, Paris, Tours, Manosque, Perpignan, Marseilles, and New York. In Milan, the electric energy is either charged for by a fixed rate per lamp per year, plus a payment for each hour during which the lamp is turned on (the fixed annual rate and the hourly payment depending on whether the lamps be of 10 or of 16 candles), or the payment may be made to depend entirely on the consumption. In the latter case, however, the hourly payment per lamp diminishes with the number of lamps employed in the building, the rate per hour varying from 6 centimes for a 10-candle lamp if there be not more than 40 lamps, to $3\frac{3}{4}$ centimes per 10-candle lamp if the number exceed 151. The incandescent lamps at Milan appear to require 6 watts per candle, and are therefore evidently specimens of the old Edison lamp; at the present day, however, there are lamps that can be incandesced with 40 per cent. less power, and still have a long life. In comparing the price of lighting by electricity and gas, M. Couture assumes that one Bengel gas-burner consuming 105 litres of gas per hour gives 10 candles. This is equivalent to 5·9 cubic feet per hour for 16 candles. Now a good Argand burner with London gas will give 16 candles for a consumption of 5 cubic feet per hour, whereas a common burner will not give more than 5 or 8 candles. M. Couture's typical burner and the Milan gas must therefore be good, whereas, as already mentioned, the incandescent lamps employed in Milan must be of an old character. Nevertheless, since electric lighting is supplied at 9 centimes per hour for a 16-candle lamp, and at 5·6 centimes (or about one halfpenny) in buildings using many lamps, the Milan Gas Company thought it wise to drop their price from 36 to 25 centimes per cubic metre of gas in the regions of the town supplied with electricity. For the benefit of readers who may study the copious information contained in this French treatise, we may mention that the London price of 2*s.* 6*d.* per 1000 cubic feet of gas is equivalent to almost exactly one penny per cubic metre.

In Rome, the Anglo-Roman Gas Company have utilized alternate-current transformers to distribute electric energy throughout the town from an electric station with 2700 horse-power, constructed on their own grounds, and have thus avoided the erection of expensive central stations in the town itself. The price charged is 8 centimes per hour for a 16-candle glow-lamp, and this M. Couture regards as a very remunerative one. It represents about $2\frac{1}{2}$ times the cost in Rome of lighting with improved 16-candle Wenham gas-burners. M. Couture speaks of the two dynamos employed there as being the largest in the world, but, as they are only of some 500 horse-power each, it is clear that the author has not heard of the dynamos at Deptford, one of which has been running for some time, and which produces 1500 horse-power. Indeed, M. Couture is wonderfully silent about the electric lighting of towns in England, and makes no reference whatever to the prices charged for electric energy at various places in this country, or to the regulation of these prices by the systematic action of the Board of Trade.

Various installations employing transformers are referred to, amongst others that at Tours, and it is mentioned that the new price charged there for electric energy is only about 30 per cent. more than for an equivalent amount of gas. The only reference to electric lighting in Great Britain is to the first use of transformers when the Metropolitan Railway stations at "Edgard Road" and "Olgate" were experimentally lighted in 1883; and of the large amount of electric lighting work that has been carried out on the Continent by English engineers nothing is said, if we except the statement that "Badkok" and Wilcox boilers are used at Marseilles and at other towns. The value of the book, which is considerable, would have been increased if some reference had been made to "Sir Siemens" and "Sir Crompton," since certain large towns abroad, not mentioned in this book, owe their electric lighting to the exertions of these firms.

Formerly, electrical companies maintained installations at a loss, for the sake of advertisement; while gas companies, to avoid losing the streets that were lighted, have continued the lighting for a return less than the cost price. The financial results of electric supply companies have often not been sufficiently prosperous to enable interest to be paid upon the capital invested, but the same may be said of many gas companies in the early days of their existence. At Dijon, a central electric station has been rendered commercially impossible by the Gas Company dropping their price from 45 to 25 centimetres per cubic metre when they heard that the erection of one was contemplated.

The Marseilles Gas Company was the first gas company to establish a central station for the purpose of ascertaining the conditions under which the new method of lighting could be advantageously used in conjunction with gas and oil. Since 1881, when the Marseilles Gas Company first took up electric lighting, they have gradually extended their operations, so that to-day the electric lighting of the town is considerable. At the rates charged, it is 20 per cent. dearer to obtain 10 candles for 1000 hours in the year by electricity than with a *good* gas-burner; but if the time of lighting be extended to 2000 hours, electric lighting is only 6 per cent. dearer than gas lighting, and in the case of a 10-candle lamp lighted for 3000 hours in the year, electricity and gas come out equal in price. Consequently, if the gas be burnt in common burners, or if governors be not employed to keep the pressure of the gas constant, lighting with gas will actually be dearer in Marseilles than by means of electric glow-lamps. However, as the author points out, it is very important to see that a 10-candle glow-lamp really gives an illumination of 10 candles, since it is by the lamp, and not by the light, that the charge is made.

Electricity is, of course, now being much used where gas was formerly employed, but an interesting example is given in this book of electricity being resorted to for the lighting of a town in which gas could not be adopted. Manosque, in the Basses Alps, was lighted, up to 1888, with oil, the municipality not being able to introduce gas,

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as nearly all the houses had cellars under the public street; but for the last two years the town has been lighted by means of electricity. The price charged is either at a fixed rate per month, independently of the number of hours the lamp is lighted, or the consumer can pay for the actual time the lamps are used at the rate of 5½ centimes per hour for a 16-candle lamp, 4 centimes for a 10-candle lamp, and 3½ centimes if the lamp be of 8 candles. It is interesting to notice that this charge of 5½ centimes per hour for a 16-candle lamp is almost exactly equivalent to 8*d.* per Board of Trade unit—the legalized rate for London.

At Perpignan, the prices per hour per lamp are the same as at Manosque, but if the lighting be charged at a fixed rate per month, the rate for a 10-candle lamp is either 3½ or 6 or 8 francs per month, depending on whether the lamp is put out every night at 10 o'clock or at midnight, or is left alight all night.

In Paris, gas costs 30 centimes per cubic metre, or, roughly, 7*s.* 6*d.* per 1000 cubic feet, while, for a 10-candle glow-lamp, 4·8 centimes per hour is charged; the user has also to pay an annual subscription of 4 francs, and he has to replace his lamp after 1000 hours at a cost of 4 francs. With these figures the author concludes that electric lighting with glow-lamps is 40 per cent. dearer than lighting with gas.

The largest single electric installations of *arc*-lamps is at Brooklyn, in America, where the Thomson-Houstin Company supply current for 1325. The following the author gives as the prices paid per hour for the current for one arc-lamp:—

Detroit	29 centimes.	
Paris	40 ,,	
Milan	44 ,,	if burning all night.
,, ...	50·2 ,,	,, only until midnight.
Marseilles ...	52·5 ,,	burning only until midnight.

To enable a comparison to be made, we have ascertained that the yearly price charged for the arc-lamps on the Parades of the English watering-places is equivalent to about 35 centimetres per arc-lamp per hour.

M. Jules Couture concludes his treatise in a very judicious manner as an old director of the Marseilles Gas Company:—"Little Jack Gas lives still, and will continue to live, I hope, for a long time yet. To prolong its existence, gas will not hesitate to inscribe on its banner, 'Gas-Electricity,' because its advocates are not at all adverse to progress."

The treatise forms a handy reference-book for those interested in the progress of electric lighting. It would have been well, however, if the author had given the price of *electric energy* in the various towns, instead of the price per ampere or the price for the current for a particular lamp. Constant reference is made to the supply of the light "*au moyen de compteurs*" in the various towns. Electrical engineers would have gladly welcomed some information as regards the character and the behaviour, satisfactory or otherwise, of the meters employed. We have already said that we think statistics of electric lighting in Great Britain might well have been added, seeing that it is now nearly two years ago since the Englishman's backwardness in taking up electric lighting began to disappear.

In justice to the consumers of gas, more stress should have been laid on the fact that ordinary gas-burners are very inefficient things. It might, for example, have been pointed out that, while as much as 6 candles per cubic foot of gas consumed per hour can be obtained with a Welsbach or with an albo-carbon burner, as little as ¾ of a candle per cubic foot consumed per hour is the meagre efficiency of certain twopenny-halfpenny nondescript burners. And if such a nondescript burner be ungoverned, as it probably will be, since people who have not the sense to buy good gas-burners are not likely to buy governors for them, then, when the pressure of the gas rises in the mains, the burner will not give more than ½ a candle per cubic foot. So that a burner passing 5 cubic feet of London gas per hour may give any illumination from 3 to 30 candles, depending on the nature of the burner.

In dealing, therefore, with the vexed question of the relative cost of lighting with electricity and gas, we must remember that, apart from glow-lamps causing much less damage than gas to books and decorations of rooms, lighting with glow-lamps at 8*d.* per Board of Trade Unit costs no more than lighting with ungoverned common gas-burners using gas at 2*s.* 6*d.* per thousand cubic feet. On the other hand, lighting with glow-lamps costs about 3 times as much as lighting with governed Argand burners, and 4 or 5 times as much as using albo-carbon or Welsbach burners.

A TEXT-BOOK OF GEOLOGY.

The School Manual of Geology. By J. Beete Jukes, F.R.S. Fifth Edition. Edited by A. J. Jukes-Browne, B.A., F.G.S. (Edinburgh: A. and C. Black, 1890.)

THE title and success of this handy little book lead one to inquire how far and where geology is taught in schools. There is no doubt that the subject has for scholars, particularly in the country, the strongest fascination; and the fine museum of Marlborough is an example of how "natural history" studies may be kept alive in seats of youthful learning. But it would be interesting to know how many schools, excluding special evening-classes, can give such a work as this a place in their curriculum, and thus carry back the history of England, Rome, and Greece to the earliest dawn of life upon the globe. The preliminary training for the appreciation of geological features such as every lad can see around him need not be excessively severe; the mere appreciation is at first the great thing—the knowledge that there is something to be learnt in road-side quarries, in familiar hollows of the hills, beside which the "Dictionary of Antiquities" seems like a fashion-book of yesterday; while at the same time, perhaps, the kinship of the boy with his favourite classic hero becomes something more real and inspiriting in face of the enormous past beyond them both.

While the work before us is a concise and convenient text-book, we suspect that, from mere force of circumstances, it aims more at the individual student than at the school-boy and the class. Just as William Smith, at the beginning of the century, pleaded for geology as a study advantageous to land-owners, so the editor appeals in his preface to the practical good sense of parents. The

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